

Attributes of a Surveillance System

The operation and characteristics of most surveillance systems are relatively complex, but every surveillance system can be described with respect to the following nine basic attributes:

- **Simplicity** refers to the system's structure and ease of operation.
- **Flexibility** is the ability of the system to adapt to changing information needs and operating conditions with minimal additional cost.
- **Data quality** is the completeness and validity of the data collected through the system.
- **Acceptability** is the willingness of persons and organizations to participate in the system, including those who operate the system, report cases of the disease, or use the data.
- **Sensitivity** is the proportion of cases of a disease detected by a surveillance system and the ability of the system to monitor changes in the number of cases over time, such as outbreaks.
- **Predictive value positive** is the proportion of cases reported through the system that are accurately diagnosed instances of the disease under surveillance.
- **Representativeness** is the extent to which the system accurately describes the occurrence of the disease over time and its distribution in the population by place and person.
- **Timeliness** reflects the delay between steps in a surveillance system and availability of information for control of the disease under surveillance when needed.
- **Stability** is the ability of a surveillance system to collect, manage, and provide data without failure and to be operational when needed.

The attributes of a surveillance system affect the ability of the system to meet its objectives and the usefulness of the resulting information. For example, if a surveillance system has a high sensitivity it will be more likely to detect outbreaks of the disease under surveillance, thereby promoting their investigation. If a system is timely, it will allow quicker initiation of control and prevention measures, limiting the spread of disease in a community.

The attributes of a surveillance system are often competing and inversely related. As one becomes stronger, others become weaker. Therefore, not all of the attributes can be at the highest level for a particular system. Efforts to improve certain attributes might detract from others and affect the overall effectiveness of the system. A conscious effort is needed to determine which attributes are most critical for a surveillance system so that the objectives of the system can be achieved.

Give it a try with the following exercises.

EXERCISE 1

Anthrax is a life-threatening disease caused by *Bacillus anthracis*, a bacterium that forms spores. In the fall of 2001, a multistate investigation identified letters intentionally contaminated with *B. anthracis* spores that had been sent through the U.S. Postal Service. Six cases of human anthrax associated with the letters were subsequently identified.

In response, the New Jersey Department of Health and the Centers for Disease Control and Prevention (CDC) began active surveillance for anthrax. The objectives of the system were to determine the magnitude of the problem and the population at risk, so that subsequent investigations could be better targeted and appropriate public health action undertaken.

Of the nine attributes of a surveillance system, which are most critical to the surveillance for anthrax?

Answer

Because of the seriousness of the disease and need to identify potential cases, the surveillance system for anthrax should have a high sensitivity and timeliness. Making the system simple and acceptable will increase the likelihood of achieving those objectives. Given the need to identify all cases, a low predictive value and data quality will be acceptable because officials will follow up on all potential cases and confirm the diagnosis and case information.

Source: Tan CG, Sandhu HS, Crawford DC, et al. Surveillance for anthrax cases associated with contaminated letters, New Jersey, Delaware, and Pennsylvania, 2001. Emerging Infectious Diseases 2002;8:1073-77.

Note: Use Shift+Ctrl+ Plus to rotate view

EXERCISE 2

Chronic diseases are among the most prevalent and costly of preventable health problems. The majority of chronic diseases have a long latency period and a protracted course. Many of them are amenable to prevention efforts such as control of risk and protective factors. Others can be managed through screening and early interventions. Results of control efforts, however, often are not recognized for a number of years after implementation.

A state health department decides to undertake surveillance of three chronic diseases: coronary artery disease, diabetes, and lung cancer. The objectives of the system are to identify the characteristics of persons at highest risk, to help plan health services and screening for secondary prevention, and to monitor the effectiveness of public health interventions directed toward each disease.

Of the nine attributes of a surveillance system, which are most critical to the surveillance for chronic diseases?

Answer

To identify groups at high risk for these diseases and to develop appropriate interventions, the surveillance system for coronary artery disease, diabetes, and lung cancer should be representative and provide high quality data. To follow the impact of interventions, stability will be necessary to examine trends over time. Because chronic diseases are common and follow-up will not occur with individual cases, sensitivity will not be particularly critical. Given the time lag in the development of these diseases, timeliness will not be as critical.

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EXERCISE 3

Varicella (or chicken pox) is a highly infectious viral disease. Before 1995, approximately 4 million persons were infected with varicella in the United States annually. In 1995, a varicella vaccine was licensed. The Advisory Committee on Immunization Practices recommended that children be routinely vaccinated at age 12-18 months, and that older, susceptible children be vaccinated by age 13 years.

With the introduction of the vaccine, CDC encouraged health departments to undertake surveillance for varicella. The objectives of surveillance were to assess the health burden of the disease over time and the impact of national and state varicella vaccination programs.

Of the nine attributes of a surveillance system, which are most critical to the surveillance for varicella?

Answer

As the varicella vaccination programs begin, a substantial number of cases will still be occurring. At that time, simplicity, acceptability, and representativeness will be critical for the surveillance of varicella. As the vaccine is administered to more children, the number of cases will decline and health-care providers will become less familiar with the disease. At that point, sensitivity and predictive value positive will become more critical. Given the desire to follow the impact of vaccination programs over time, stability will be essential throughout the course of surveillance activities.

Source: Centers for Disease Control and Prevention. Evaluation of varicella reporting to the National Notifiable Disease Surveillance System -- United States, 1972-1997. Morbidity and Mortality Weekly Report 1999;48:55-8.

Note: Use Shift+Ctrl+ Plus to rotate view